

Appendix XIV.4-H

Shredder/Chopper Process Description

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I. Description of Treatment Equipment

A shredder, a chopper, and a hydraulic power unit (HPU) will be installed in Rooms 1038, 1039, and 1040, respectively, of the Liquid Waste Processing (LWP) area to supplement the size reduction capabilities. The design and the operation of the shredder and the chopper are basically identical. Both pieces of equipment use low-speed, high-torque rotating cutting surfaces to size reduce debris through ripping, shearing, and tearing. The HPU operates both the shredder and the chopper. The descriptions and requirements listed in this appendix are based on those in the specifications package for the shredder and the chopper and the proposal from the manufacturer, Shredding Systems, Inc. All numerical values provided in this process description are approximate and represent normal operations.

1.1 Purpose

The shredder and the chopper will be used to process solid mixed and hazardous wastes—such as debris, filters, and empty containers—as well as cloth, paper, cardboard, and other fibrous materials by reducing them to smaller pieces in order to facilitate packaging and consolidation. The shredder and the chopper may also be used to process nondebris and/or nonhazardous waste materials.

The Land Disposal Restrictions (LDRs) treatment standards (see Title 22 of the California Code of Regulations [CCR] 66268.45, Table 1) state that debris must be size reduced so that the thickness of the debris does not exceed 1.2 cm (in one dimension) prior to treating debris by water washing or liquid phase solvent extraction (e.g., a debris washer). The shredder and the chopper are designed with this size-reduction requirement. The size-reduced debris from the shredder and the chopper may also be sent to the solidification system or consolidated in waste containers for off-site shipment.

1.2 Equipment Operations

The shredder and the chopper are very similar, and each is comprised of cutters, a hopper, an in-feed hopper ram, a hydraulic dumper, and operating controls. However, the chopper has smaller cutting chamber dimensions and narrower rotating cutter width to reduce waste into smaller pieces than does the shredder, and the chopper also utilizes a screen on its discharge. The HPU operates the shredder and the chopper with either the shredder or the chopper being operated at one time.

Figure 1 provides a process flow schematic for the shredder and the chopper. As shown on **Figure 1**, a hopper directs the debris to the cutting surfaces. Although not shown on this schematic, the hopper includes a hydraulically operated in-feed hopper ram to ensure capture and efficient reduction of hard-to-feed bulky materials. The hopper has a lid which is closed during size reduction operations to protect workers from debris that may be propelled by the cutting

surfaces and to prevent airborne emissions. A ~~blower with a~~ high-efficiency particulate air (HEPA) filter will be provided to capture airborne particulates that may be generated during size-reduction operations. The filtered exhaust is vented directly into the Building 695 ventilation system which also is HEPA-filtered prior to being discharged to the atmosphere.

The shredder and the chopper are equipped with a hydraulic dumper lift to raise waste containers and dump their contents into the hopper. A forklift may also be used to lift bulky items into the hoppers. An entire waste container may be dumped into the chopper; however, waste containers are not normally placed into the shredder. Clamps secure a container to the hydraulic lift to prevent the container from falling into the shredder as its contents are dumped.

The cutters are heavy-duty, slow-speed, rotary-shear type. The cutters rotate in opposite directions, but cutter rotation is automatically reversed when an overload is sensed. The cutting surfaces are attached to two shafts which are powered by an HPU. (As mentioned above, this HPU serves both the shredder and the chopper, but only one piece of equipment is operated at a time.)

A waste-receiving container is placed under the discharge portal. A transitional sleeve between the discharge portal and the receiving container is provided to direct the size-reduced debris into the waste-receiving container.

Debris exits the shredder and the chopper as strips. A discharge screen is attached to the discharge portal of the chopper to ensure that only shredded materials smaller than a predetermined size are allowed to fall into the container below. Oversize remainders are re-introduced into the shredding process until the desirable size is achieved.

1.3 Types of Waste to Be Treated

The types of hazardous wastes to be managed in the shredder and the chopper are listed in the **Part A** and **Table XIV.4-2**. Feed material will be dry, hazardous waste debris that may include rubber, thin-gauge metals, glass, wood, paper, leather, cardboard, and other materials that can be size reduced. The debris may be contaminated with various hazardous and radioactive constituents.

II. Effectiveness of Treatment

II.1 Treatment Performance Information

The treatment performance of the shredder and the chopper is based on visual observation to verify that the debris were size reduced. Samples are collected and analyzed only if required to resolve reoccurring equipment problems.

II.2 Process Controls

The shredder and the chopper have instruments, individual control panels, and one central programmable logic controller (PLC) which monitors and/or adjusts the items listed below:

- The control panel has audio and visual alarms, and a PLC display as well as buttons for shredder/ chopper start, stop, reverse, and reset; HPU operation; lid operation; dumper operation; and emergency stop.
- Controls allow the high torque and time in reverse mode to be set.
- The PLC monitors for and the control panel displays:
 - HEPA differential pressure.
 - Shredder or chopper pre-filter differential pressure.
- The PLC locks out the shredder or chopper operation and signals a distinct alarm for each of the following:
 - Open hopper lid.
 - Insufficient airflow available to operate the shredder or chopper based on input signal.
 - Insufficient differential pressure across the exhaust air valve based on input signal.

The shredder or the chopper exhaust stream radioactivity is monitored by a continuous air monitor (CAM) or equivalent device.

Normally, the shredder and the chopper are manually operated. Each piece of equipment has three manually operated, lockout ball valves with limit switches which input into the PLC. These ball valves function to direct hydraulic flow and pressure to the piece of equipment selected to be operated. If these valves are not in the correct positions, the PLC will not allow the selected piece of equipment to operate.

II.3 Inspections and Maintenance

Operators are properly trained prior to being allowed to operate the shredder or the chopper unsupervised. A pre-operational safety inspection is conducted each day that the shredder or the chopper is to be used. At a minimum, the following items are visually inspected:

- Wear and damage of moving parts, especially the cutters.
- General condition of the system (e.g., checked for loose fittings or bolts, frayed wires, worn or broken seals, duct damage, clear access, etc.).
- Proper function of instruments, alarms, interlocks, and emergency shutoff controls.

III. Equipment Specifications

The design specifications for the shredder and the chopper are based on the specification bid package and the proposal from Shredding Systems, Inc., for shredder models 1500H and 1450H. These specifications are representative of the equipment to be installed in the LWP area.

A schematic cross-sectional view of the shredder and the chopper is included as **Figure 2**. The material of construction of the shredder and the chopper is steel. Drop-in bolts anchor the shredder and the chopper to the concrete floor. Electric power and instrument air are supplied to the equipment from the Building 695 utility systems.

III.1 Hopper and In-feed Hopper Ram

A hopper directs debris into the shredder or the chopper to the cutting surfaces for batch operations. The hopper is equipped with a lid that is closed during shearing operation to protect workers from debris that may be propelled by cutting surfaces and to prevent airborne emissions. The lid is equipped with an actuator for remote operation. A view port with a built-in light is provided at each end of the hopper. The hopper and its lid are designed to accommodate various sizes and types of materials, including 85-gal drums. A connection is provided for exhaust ductwork to accommodate a minimum of 125 feet per minute of face velocity when the hopper lid is open.

The hopper includes a hydraulically operated in-feed hopper ram to ensure capture and efficient reduction of hard-to-feed bulky materials. The ram operates in both automatic and manual modes to allow the user to operate it as required. In automatic mode, the in-feed hopper ram senses cutter loading and automatically retracts the ram for maximum processing efficiency. The in-feed hopper ram is shielded from the material being size reduced.

III.2 Cutters

The 16.8-in.-diameter, hardened-steel cutters are heavy-duty, high-torque, slow-speed, rotary-shear type with rounded keyed shafts. The cutters rotate in opposite directions and automatically reverse rotation when sensing an overload. After reversing, the shredder or the chopper resumes its forward rotation. If the overload continues after a pre-set number of reversals during a pre-set time period, the shredder or the chopper shuts down.

A cutter locking system design utilizes a pre-load hub assembly that provides for a tighter cutter stack. This improves the cutter performance, increases cutter life, reduces the likelihood of shaft damage or failure, and eliminates the need for frequent cutter-stack tightening.

III.3 Cutting Chamber

The cutting chamber dimensions are 32 in. × 52 in. × 17 in. for the shredder, and 32 in. × 40 in. × 17 in. for the chopper. The cutting-chamber design isolates system bearings and seals from processed material. This design incorporates splash plates at each end of the cutting chamber which prevent shredded material from entering the sealed area. (**Figure 3** shows a schematic detail of the cutter assembly.) Hookless cutters adjacent to the splash plates ensure that no shredding occurs directly against the splash-plate walls. The cavity between the splash plates and cutter end-walls has no bottom to keep material that has slipped past the splash plates from reaching the seals and bearings. Cleaning fingers in the cutting chamber prevent materials from accumulating between cutters or wrapping around the shredder's or the chopper's shaft.

III.4 Hydraulic Dumper Lift

The shredder and the chopper each have a portable hydraulic dumper lift to raise a waste container (55- or 85-gal capacity with a maximum weight of 1000 lb) and dump its contents into a hopper. Clamps are used to secure a container to the hydraulic lift to prevent it from falling into the cutter as its contents are dumped.

The hydraulic dumper is also equipped with quick-disconnect cables for the controls. If a dumper is connected, presumably the operator wishes to use the dumper; and the dumper is the required operation of the system. If the dumper is not connected, that system is allowed to operate as a free-standing unit without the dumper being part of its operation.

III.5 Hydraulic Power Drive (HPU)

The cutting surfaces of the shredder and the chopper are each attached to two shafts powered by a single HPU. This HPU serves both the shredder and the chopper, but only one piece of equipment can be operated at a time. Lockout ball valves allow the operator to select the piece of equipment to be operated.

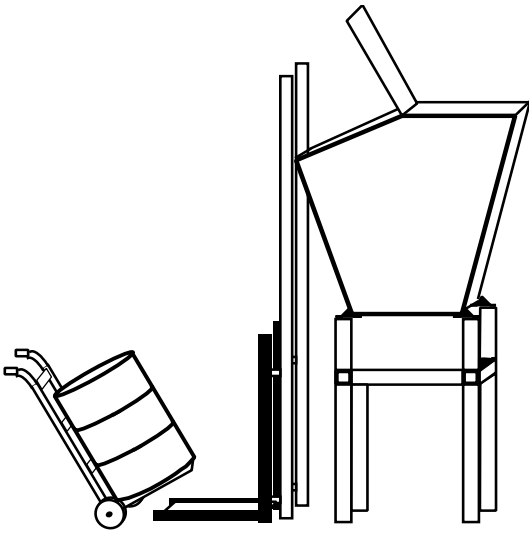
The HPU consists of a hydraulic pump and a hydraulic motor. The HPU has a total system flow of 47 gpm and port pressures of 1700 psi and 4000 psi. The hydraulic drive is in a direct-drive arrangement. Speed reduction and torque amplification are accomplished with a high-efficiency, force-balanced planetary gearbox splined directly onto the drive shaft. The drive train driving the opposite shaft is easily inspected through quick access in the gearbox housing. The shaft torque ranges from approximately 32,500 to 49,900 ft-lb, and shaft speeds range from 12 to 18 rpm.

A 75-horsepower, 480-V, 3-phase, 60-Hz electric motor powers the HPU.

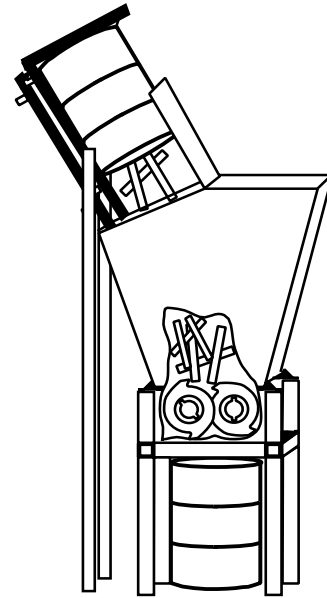
Multiple relief valves provide severe-shockload protection for the cutters, shaft, and drive train.

IV. Equipment Drawings

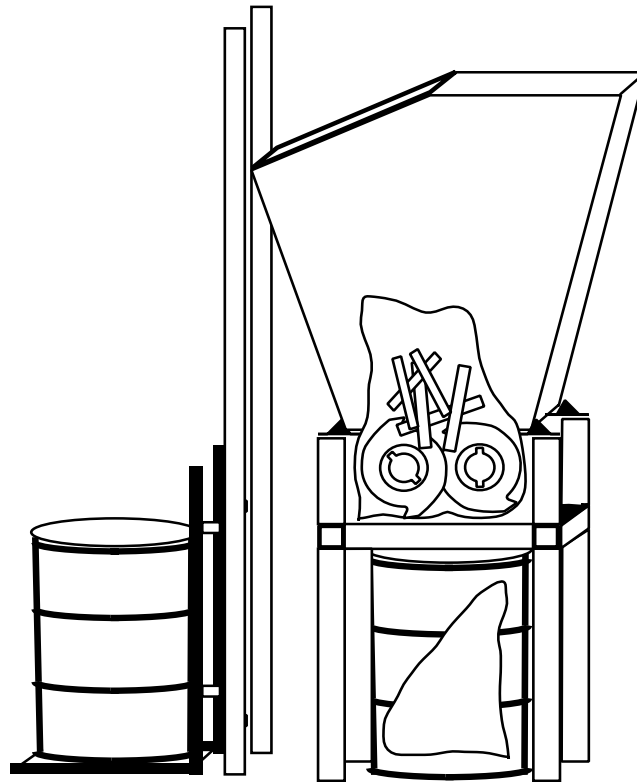
Drawings 00-6780-D sheets 1 and 2, and 01-6874-B sheet 1 (obtained from the proposal from Shredding Systems, Inc., for shredder models 1500H and 1450H) are included to provide a more detailed visual depiction of the shredder and chopper to be installed. The HPU parts list is included as Table 1. The actual equipment installed within the Building 695 Storage and Treatment Unit Group are expected to have a similar design but may deviate from the dimensions, capacities, notes, and other information presented on these drawings. If deviations do develop, updated layout and equipment drawings for the shredder and the chopper will be provided to the California Department of Toxic Substances Control after the equipment is installed.



Step 1 - Drum Loading



Step 2 - Drum Emptying



Step 3 - Size Reduction

Figure 1. Process Flow Schematic of the Shredder/Chopper

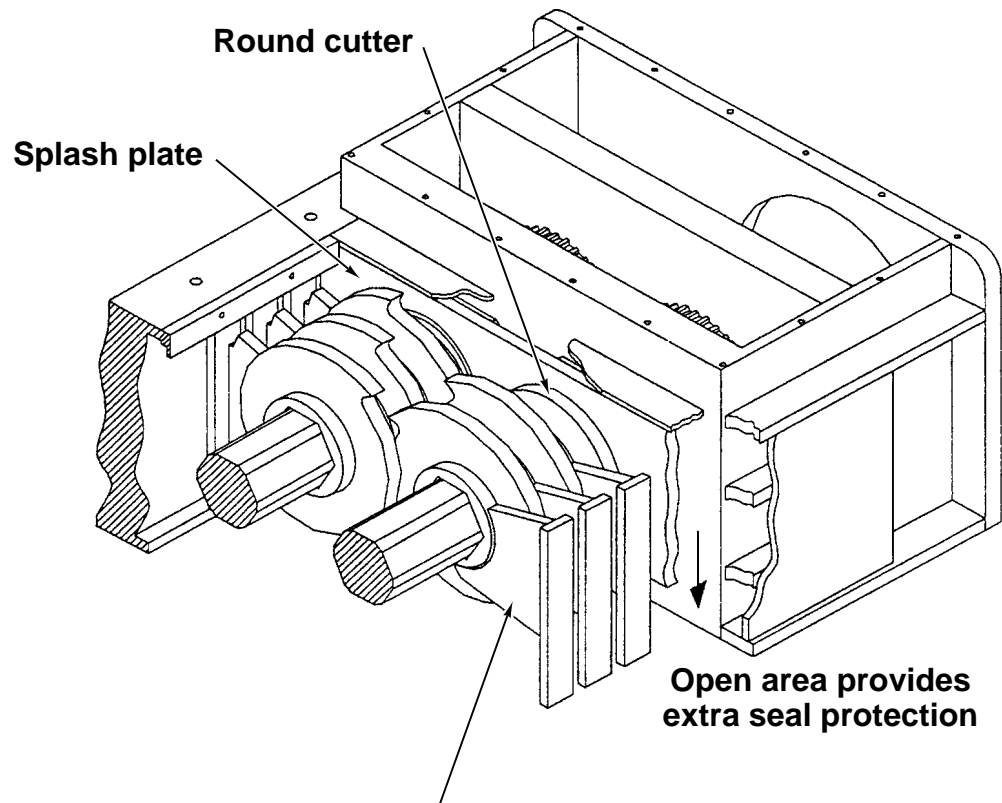


Illustration of segmented, or floating, cleaning fingers fitted into the cutting chamber. Notice that the steel plates actually extend between the shredder's cutters.

Standard cutter profiles

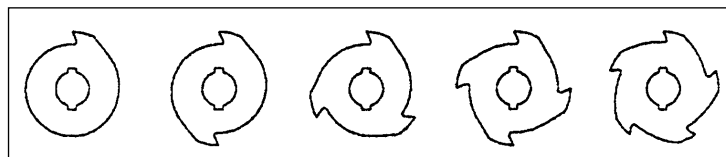


Figure 3. Schematic Detail of the Cutter Assembly

Shredder Drawings.

Click on the title to see the drawing

[Layout Shredder Plan View – sheet 1](#)

[Layout Shredder Plan View – sheet 2](#)

[Schematic –Hydraulic – sheet 2 \(see next page for sheet 1\)](#)

Table 1. Hydraulic Power Unit Parts List for Drawing number 01-6874-B sheet 1

0	Hydraulic power unit	31	Valve body
1	Reservoir	32	1-gal accumulator
2	Hydraulic oil	33	Accumulator bracket
3	Filler/breather	34	Terminal box
4	Sight gauge	35	Back panel
5	Temp switch—cold oil	36	Hose assembly
6	Temp switch—cooler	37	Hose assembly
7	Temp switch—hot oil	38	S/F kits
8	Heater—1500 watt	39	Manifold
9	Float switch	40	Pressure reducing/relieving valve
10	Ball valve	41	Pilot-operated two-way valve
11	Limit switch	42	D03 directional control valve
12	Limit switch arm	43	Pump—7.6 gpm PC vane
13	46-gpm hydrostatic pump	44	Check valve—3/4" NPT
14	Electric motor—75 hp	45	D03 manifold—4-bank
15	Pump mount bracket	46	D03 4-way valve—3-position
16	Coupling	47	D03 "P" port pressure-reducing valve BO
17	Pressure gauge—5000 psi	48	Reducing valve
18	Pressure gauge—600 psi	49	D03 "P" port float control
19	Gauge tap—#4 SAE	50	PC float control valve
20	Gauge adapter	51	Pressure switch—3000 psi
21	Forward pressure switch	52	Gauge test port—1/4" NPT
22	Hot-oil shuttle manifold	53	Pressure gauge—3000 psi
23	Hot-oil shuttle valve	54	6-port selector valve
24	Charge relief valve	55	N.O. logic valve
25	Check valve	56	Shuttle valve
26	Heat exchanger	57	D03 directional valve
27	Return filter	58	Cavity plug
28	Element	59	3000-psi shut-off valve with locking hand
29	Suction strainer	60	6000-psi shut-off valve with locking hand
30	Check valve—30 psi		